Interorbital Systems’ Dedicated, Non-RideShare, and Co-Manifested TubeSat/CubeSat Launch Programs
About Interorbital Systems

- Founded in 1996
- End-to-end R&D and manufacturing facilities
- Two operational rocket engine test sites
- Location: Mojave Spaceport in California
- Launch Operations (land): IOS’ private spaceport, Kingdom of Tonga
- Launch Operations (ocean): Worldwide

Interorbital Systems
www.interorbital.com
Pressure-Fed Rocket Engines
GPRE 2.5KLMA Liquid Oxygen/Methanol Engine: Thrust = 2,500 lbs.
GPRE 0.5KNFA WFNA/Furfuryl Alcohol (Hypergolic): Thrust = 500 lbs.
GPRE 0.5KNHXA WFNA/Turpentine (Hypergolic): Thrust = 500 lbs.
GPRE 3.0KNFA WFNA/Furfuryl Alcohol (Hypergolic): Thrust = 3,000 lbs.
GPRE 6.0KNHXA WFNA/Turpentine (Hypergolic): Thrust = 6,000 lbs.
GPRE 10.0KNHXA WFNA/Turpentine (Hypergolic): Thrust = 10,000 lbs.

Pressure-Fed Sounding Rockets
Neutrino: GPRE 0.5NFA Engine
Tachyon: GPRE 3.0KNHXA Engine
CPMTV: GPRE 6.0NHXA Engine
CPM SR45: GPRE 6.0NHXA Engine

Manned Systems
Dick Rutan’s Global Hilton Project
Helium/Hot Air Balloon System Propane Tanks

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Key Rocket Hardware Built In-House

Advanced Composites including state-of-the-art lightweight propellant tanks

Advanced Guidance Hardware and Software

Ablative Rocket Engines and Components

Modular Rocket Components

Small Satellites: TubeSat Kit

Rocket Injectors, Valves Systems, and other Metal Components

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- A rounded hexadecagonal form-factor
- Assembled primarily from printed circuit boards (PCBs)
- The satellite’s system PCBs are stacked and separated by standoffs
- 8 Solar Cell PCBs and 8 aluminum radiator strips form the outer shell
- Dipole antenna
- Diameter = 8.9 cm (3.5 in) Length = 12.7 cm (5 in)
- Mass = 0.75 kg (1.65 lb)
- Experiment or Application mass = 250 g (0.55 lb)
IOS TubeSat PCBs

Solar Cell PCB

Antenna PCB

Microcontroller PCB

Power Management PCB

Transceiver PCB

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- PCB Gerber Files
- 50 Spectrolab TASC solar cells
- A Transceiver (Radiometrix or Microhard n920F or n2420F)
- A Li-ion battery pack (3.7 V 5200 mAh)
- Microcomputer (NetMedia BasicX-24)
- Antennas
- Fasteners
- Complete instructions

The IOS TubeSat kit also includes a launch to a 310-km circular polar orbit on the IOS N45 rocket!
Environmentally Safe, Storable, High-Density Hypergolic Propellants
  White Fuming Nitric Acid (WFNA) and Turpentine/Furfuryl Alcohol
  Instantaneous chemical ignition eliminates need for complex ignition system

Low-Cost Propellant Tank Technology
  Custom aluminum tank liners and tank ends
  State-of-the-art composite tank reinforcement technology

Blowdown Propellant Feed
  Eliminates the need for turbopumps or a separate pressurant system

Unique Rocket Engine Injector
  Automatically maintains propellant jet flow rate in blowdown mode
  Maximizes specific impulse over a wide pressure input range

Differential Throttling and Fluid Injection Rocket Steering Technology
  Allows all rocket engines to be fixed
  Valves control the rocket attitude
  Hold downs are not required

Modular Rocket System – The Common Propulsion Module (CPM)
  Low-thrust rocket engines
  Low rocket engine development cost
  Small diameter tanks; slosh baffles not required
  Individual rocket modules can be flight tested at a very low cost
  Launch vehicle can be customized for any payload
  Assembly-line mass production
- The Common Propulsion Module (CPM) is the basic building block of the N-Series Rockets
- Bi-propellant storable, hypergolic liquid rocket system
- Blowdown propellant feed
- State-of-the-art composite propellant tanks
- Throttleable, ablatively-cooled rocket engines
- CPMs clustered together in multiples to meet mission requirements
Number of Stages: 3 (parallel and tandem staging)
Length: 31.5 feet (10.3 m); Maximum Diameter: 6.2 feet (1.89 m)
GLOW: 18,700 pounds (8,841 kg)
N30: Five (5) Common Propulsion Modules
N45: Seven (7) Common Propulsion Modules
N30 Booster Thrust = 4 X 6,000 lbs = 24,000 Lbs SL (106,752 n)
N45 Booster Thrust = 6 X 6000 lbs = 36,000 pounds
Satellite Module includes a liquid or solid kick engine or motor

N30: Payload = 30 kg
N45: Payload = 45 kg
Portable, dedicated small sat launchers

Easy to transport on highways, ocean, or by air in standard 40-foot cargo container

Can be launched from land or sea

Launched from land from a Mobile Launch System

Launched from the ocean using the Floating Launch Method

Launch-on-Demand System

Ultra low-cost, rapid access to space

Four low-altitude test flights cleared by FAA for 2010

Three Orbital Missions planned for 2011
CPM TV: Common Propulsion Module Test Vehicle

- Low-altitude unguided flight (1) (35,000-50,000 ft)
- Low-altitude with guidance flights (2) (35,000-50,000 ft)
- Hover test (low altitude) (1)
Hydraulic lift system

Equipped with propellant-fill hardware

A full-service rocket transportation and launch unit

Mobile launch platform for IOS CPM SR45 sounding rocket program
Rocket Engine Static Test Infrastructure

- New Vertical Test Stand
- Maximum thrust capacity = 12,000 lbs
- Rocket plume does not impact ground

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Standard Orbit
Circular Polar
310-km (higher altitudes available)

Estimated 1.5 to 3 month decay to reentry

- TubeSat Payloads (48)
- CubeSat Payloads (30)
- Combined TubeSat and CubeSat Payloads (variable)
- Single small satellite (up to 45-kg)
  Max Payload Size: 60 cm X 80 cm (square or round cross section)

Customized orbits are available
End of First Quarter 2011: 32 TubeSats and 10 CubeSats
   Orbit: Circular Polar
   Altitude: 310 km

Second Quarter 2011: 20 CubeSats
   Orbit: Circular Polar
   Altitude: 620 km
**CubeSats**

- UC Irvine
- EuroLuna (2U from Denmark, GLXP Team) MiniRomit 1
- Universidad de Puerto Rico

**TubeSats**

- Morehead State University (Kentucky)
- InterAmerican University of Puerto Rico
- University of Sydney (Australia)
- Aslan Academy (Private LA High School)
- Project Calliope (Space Music Project)
- SYNERGY MOON (GLXP Team)
- Naval Postgraduate School (3) (Maritime Interdiction)
- Defense Science and Technology Lab (DSTL, UK)
- An unnamed US Military client
- Austrian Arts Group [mur.org](http://mur.org)
- United States Military Academy at West Point

- 20 additional projects with committed payloads are in various phases of arranging funding. These include academic, arts, private-sector, military, and corporate groups from the US, Peru, Mexico, Germany, Vietnam, Pakistan, Brazil, New Zealand, the Dominican Republic, Holland, and France.
Launch Vehicle: NEPTUNE 45 (N45)

Orbit Type: Circular Polar
Orbital Altitude: 310 km

Price List

CubeSat: $12,500 (launch only)
TubeSat: $8,000 (basic kit including launch)

Single 45kg Satellite Payload: $384,000

TubeSat slots available for first orbital mission: 18

CubeSat slots available: 5
- CubeSat or TubeSat form-factor
- Maximum mass per single satellite unit: 1 kg
- Number of units: 12 units (multiple 2U and 3U satellites acceptable)
- Price: $25,000 per satellite (kit cost not included)
- Current Manifest:
  University of Sydney has reserved space for a 2U CubeSat